Session 108

PDF, Quartz, and Mac OS X

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Quartz Imaging Technologies

Agenda

- What is PDF?
- How does Mac OS X use PDF?

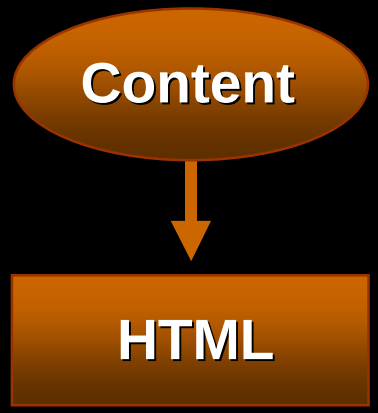
What Is PDF?

- A file format
- Provides a persistent representation of document layout
- Independent of software, hardware, and operating system

Specification

- Published specification
- PDF 1.3, 2nd edition available now
- PDF 1.4 “differences” available from Adobe

Document Representations



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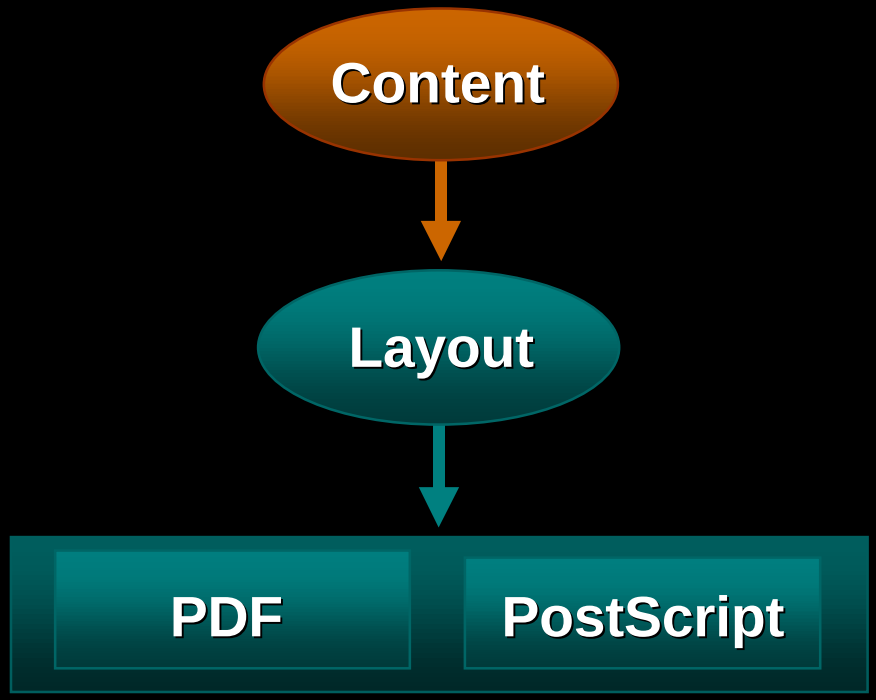

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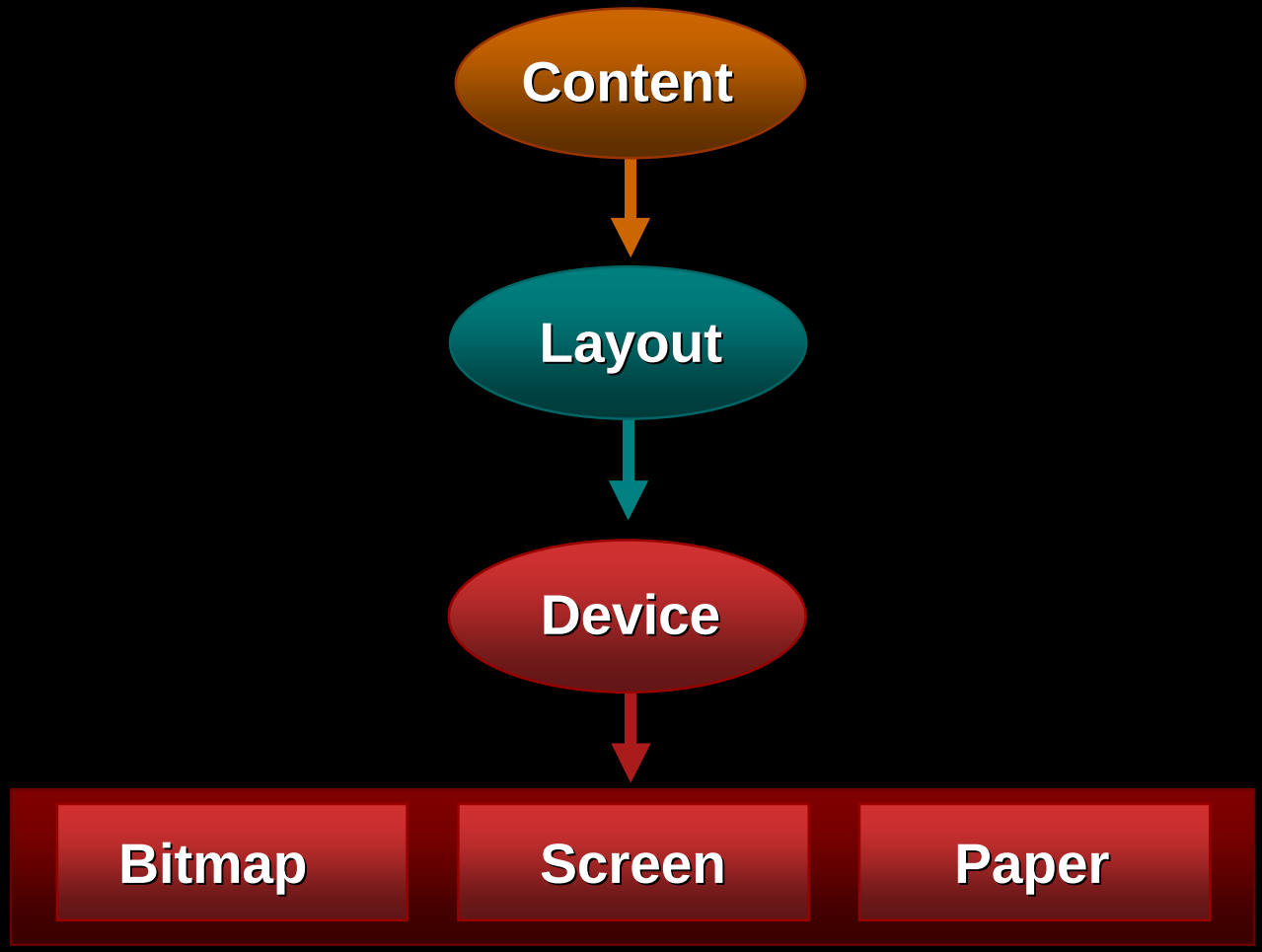
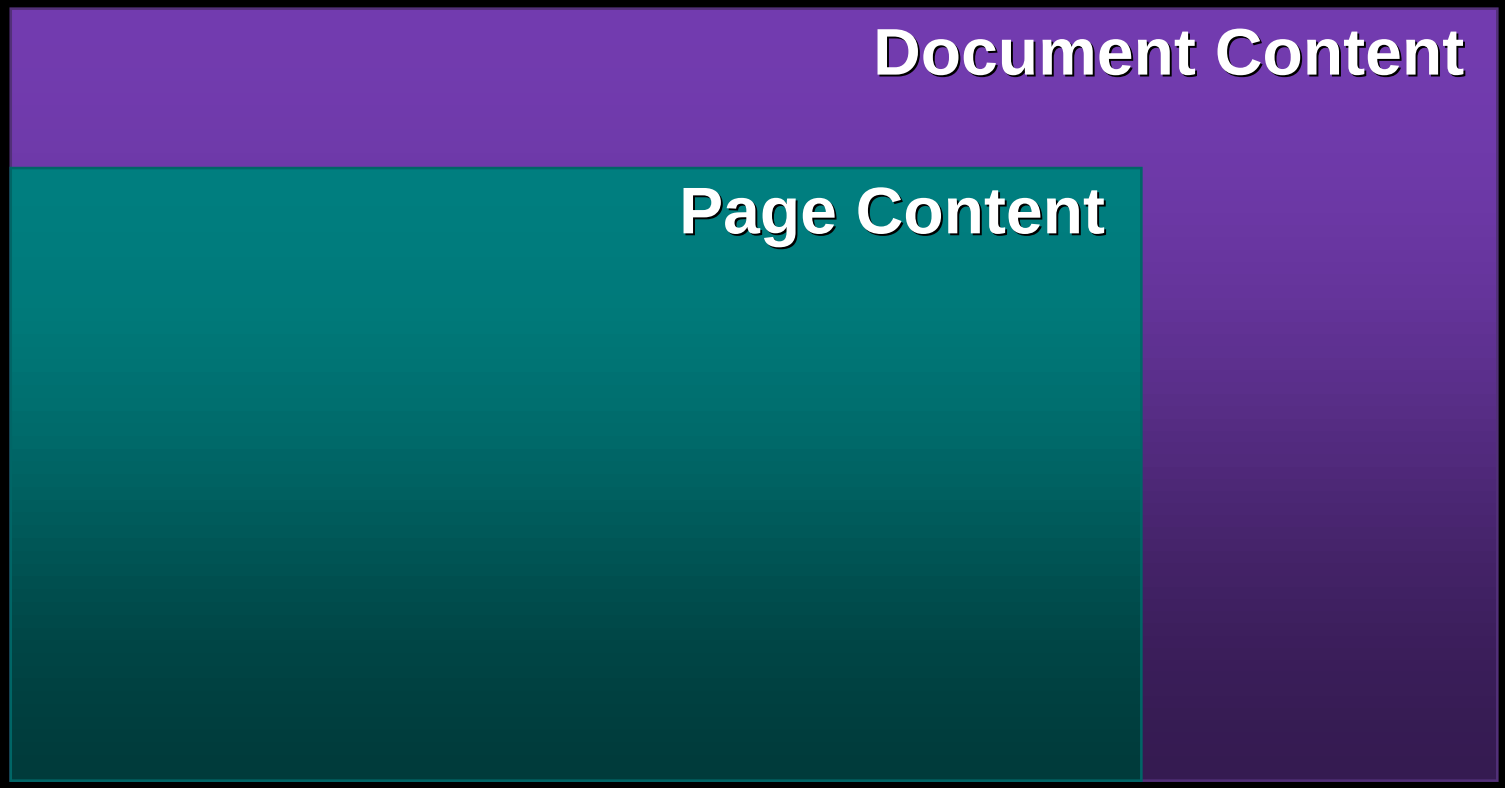


Two Parts to PDF

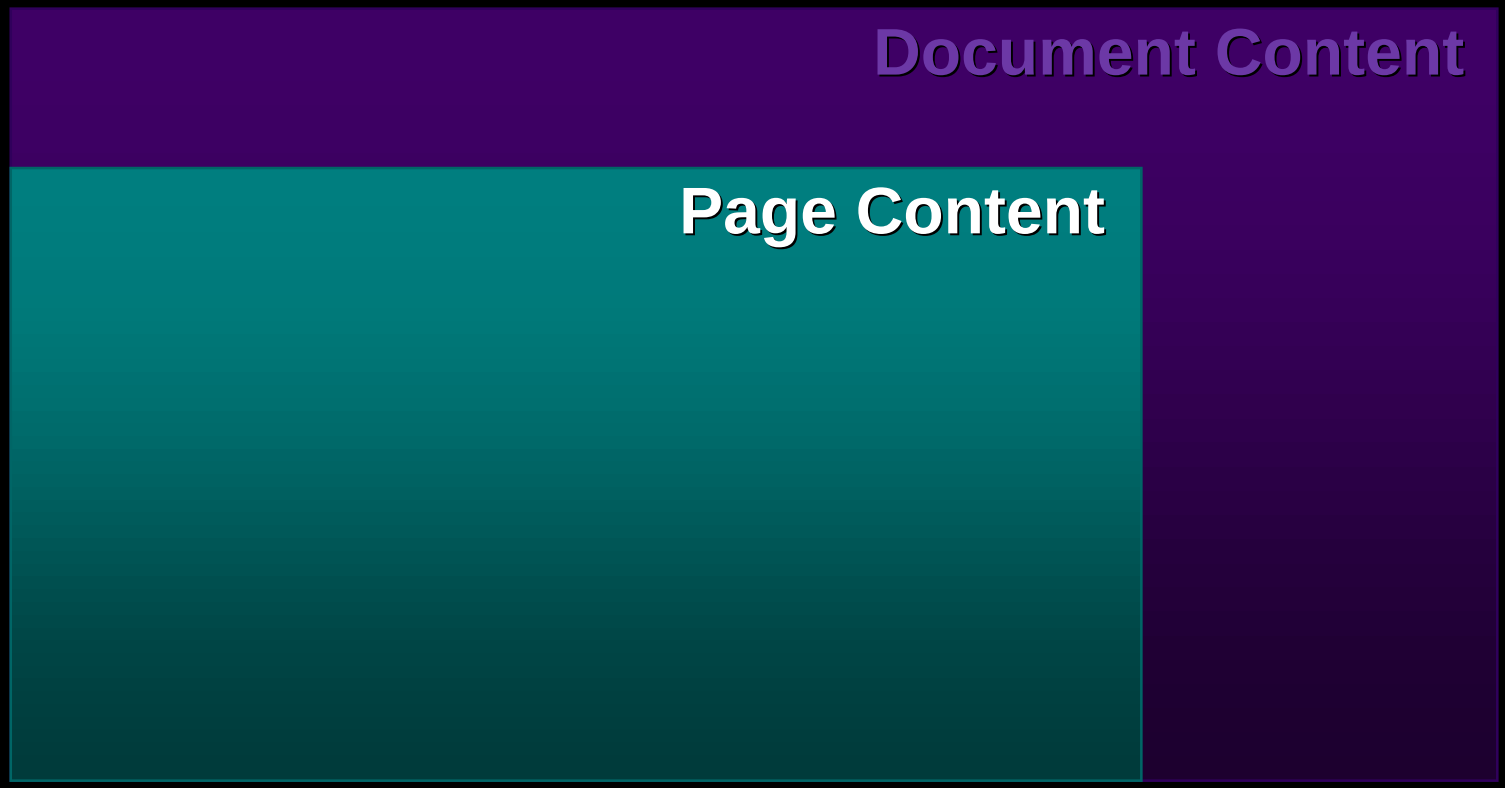


Two Parts to PDF

- Document content
  - Annotations
  - Hypertext links
  - Interactive forms
  - Logical structure tagging (PDF 1.4)
- Page content
  - Text
  - Vector art
  - Sampled images

Two Parts to PDF

- Quartz2D uses PDF page content as its persistent graphics format



PDF Page Descriptions

- Represents a document in a device and resolution-independent manner
- Contents are independent of creator
- Based on the PostScript imaging model

What's an Imaging Model?

- Abstract specification of how graphics are added to a page
- May describe simple or complex artwork, depending on needs
- Most 2D imaging models support fonts, vector art and sampled images

The PDF Imaging Model

- Painter's algorithm
- Painted figures may be glyphs, vector art, or sampled images
- "Paint" may be color, shades of gray, repeating patterns, or gradients
- Painting performed only within current clip region
- PDF and PostScript imaging models are the same
  - PDF is not PostScript, however

PDF Documents

- PDF documents contain one or more pages
- Each page may contain text, vector art, and images
- Documents contain metadata describing additional properties

Vector Art

- Constructed from connected and disconnected points, lines, and Bézier curves
- May be stroked or filled, or used to specify clipping regions
- Vectors mapped through current transformation matrix

Sampled Images

- Rectangular array of image samples
- Each sample represents a color at a point in the rectangle
- Support for 1, 2, 4, and 8 bits/component
- Samples mapped through current transformation matrix

Fonts

- Glyphs may be stroked or filled, or used to specify clipping regions
- Glyphs mapped through current transformation matrix

Fonts (Cont.)

- Common font formats fully supported
  - Adobe Type 1
  - Adobe Type 1 Multiple Master
  - Adobe Compact Font Format
  - Adobe Type 0
  - CID fonts (for CJKV)
  - TrueType

Fonts (Cont.)

- Font embedding
- Font subsets
- Font descriptors for font “fauxing”

Color Spaces

- Used with vector art and fonts to specify fill or stroke color
- Used with sampled images to specify interpretation of image samples
- Provides easy color management via ICC profiles
  - Fully compatible with ColorSync

Color (Cont.)

- Device-dependent color
  - DeviceGray, DeviceRGB, and DeviceCMYK
- Device-independent color
  - Calibrated gray and RGB
  - L*a*b*
  - ICC profiles

Color (Cont.)

- Special colorspaces
  - Indexed
  - Separation and “DeviceN”

Data Compression in PDF

- Lossless mechanisms for page content
- Lossless and lossy mechanisms for image data

Page Content Compression

- LZW (Lempel-Ziv-Welch) compression
- Flate compression
  - Based on lib/deflate compression method (RFCs 1950 and 1951)

Image Data Compression

- Lossless compression
  - PNG-equivalent using Flate compression
  - CCITT Group 3 and 4 and run-length encoding of grayscale images
  - PDF 1.4 adds JBIG2 for grayscale images
- Lossy compression
  - JPEG compression of color and grayscale images
  - JBIG2 for grayscale images

PDF Generation and Display

- Single-pass file generation
  - Big win when spooling
- Random-access when reading
  - Cross-reference table
  - Access time is independent of the number of pages in the document

Page Independence

- No need to process earlier pages to display a given page
  - Huge advantage for display
  - Very different from PostScript and other graphics formats

How Is PDF Different From Postscript?

- No programming constructs (such as **for** or **loop**)
- Files may contain objects (such as hyperlinks) that are useful only for interactive viewing

PDF Differences (Cont.)

- Strictly-defined file structure, enabling random access and page independence
- Additional information (such as font metrics) to help ensure viewing fidelity

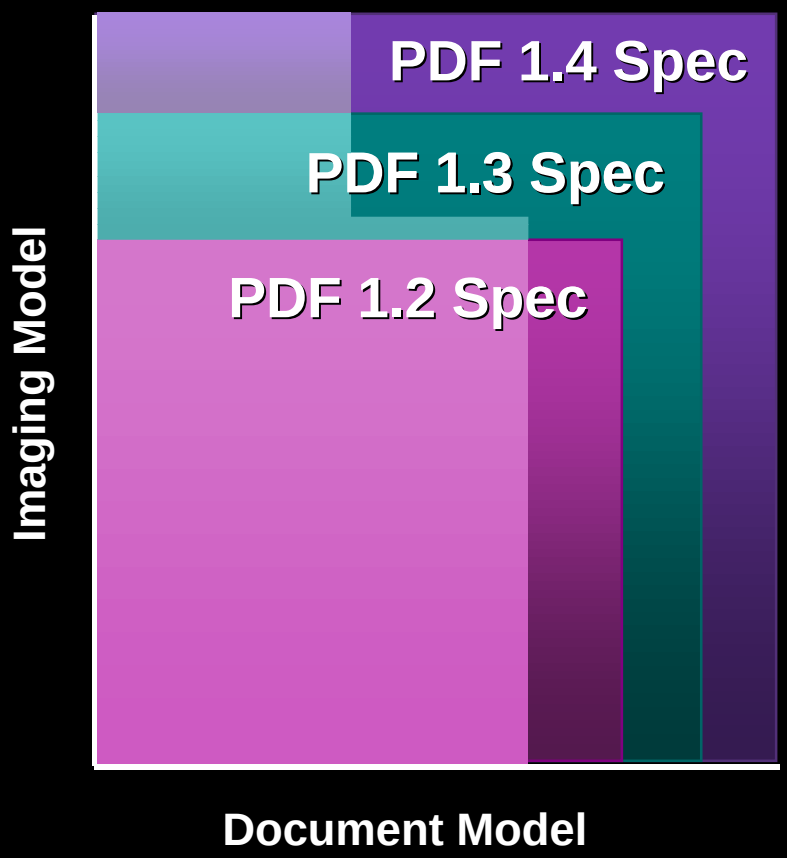
Why PDF in Mac OS X?

- We needed a persistent graphics file format which was
  - Robust
  - Industry-proven
  - Compatible with the PostScript imaging model
  - Cross-platform
  - Resolution and device independent
  - Sophisticated in its font support

How Does Mac OS X Use PDF?

- Quartz 2D
  - Apple's implementation of the PDF imaging model
  - PDF is the Quartz 2D persistent graphics format
  - Quartz 2D continues to track Adobe's PDF standard

PDF Page Descriptions



- Based on 1.2 specification plus most of 1.3
- All of 1.3 and 1.4 coming

How Does Mac OS X Use PDF?

- High fidelity “digital master” recording of application drawing
- Spooling format
- Cocoa’s NSPDFImageRep class
- QuickTime Graphics Importer
  - Used in Finder
- Improved document workflow
  - Application generates PDF directly

Summary

- PDF is a powerful, industry-standard format for high-fidelity document representation
- Used natively in Mac OS X for persistent graphics format
- Quartz 2D imaging model built on top of PDF imaging model

For More Information

- Adobe PDF Reference
  - **http://partners.adobe.com:80/asn/developer/acrosdk/docs/PDFRef.pdf**

Roadmap

108 PDF, Quartz, and Mac OS X: Learn about Mac OS X's support for PDF	Room J2 **Tues., 9:00am**
107 2D Graphics Using Quartz: An Introduction to Quartz 2D	Room A1 **Tues., 10:30am**
110 Drawing Unicode Text with ATSUI: Learn how to draw Unicode text on Mac OS X	Room J2 **Tues., 3:30pm**
117 Image Capture Framework: System-level support for Digital Cameras	Room C **Wed., 10:30am**

http://developer.apple.com/events/urls.html

Roadmap

118 ColorSync: The color engine of Mac OS X	Room C **Wed., 2:00pm**
113 Text on Mac OS X: All about DrawThemeText, Unicode Edit Text Control and MLTE	Hall 2 **Wed., 3:30pm**
404 OpenGL: High Performance 2D Blazingly fast 2D graphics using OpenGL	Room J2 **Wed., 3:30 pm**
124 Printing: Using Mac OS X's print architecture	Room A2 **Thurs., 3:30 pm**

http://developer.apple.com/events/urls.html

Roadmap

132 G&I Tips and Tricks: Optimize your graphics and printing	Room A2 **Fri., 9:00am**
FF118 Feedback Forum: Graphics Give us your feedback on Mac OS X graphics	Room J1 **Fri., 2:00pm**

http://developer.apple.com/events/urls.html

Who to Contact

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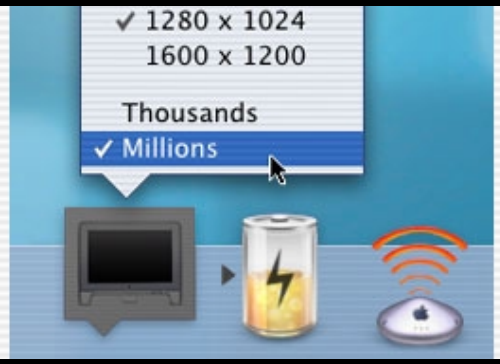
Q&A



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WWDC

Worldwide Developers Conference 2001